GREENHOUSE GAS EMISSIONS FROM FIRE AND THEIR ENVIRONMENTAL EFFECTS

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Background

Fires directly impact the carbon balance of forests through emissions of CO_2, volatile organic compounds (VOCs) and other greenhouse gases (GHG) formed during combustion of vegetation and litter. We currently lack all but the most rudimentary knowledge of the direct effects of fuel reduction fires or their secondary effects on ecosystem carbon balances and other attributes of forests and surrounding land uses.

Some researchers claim that Australian forests must be protected from management activities to maximise stored carbon (Mackey *et al*. 2008, ANU E Press). Exactly the opposite view is espoused by leading US researchers (Hurteau *et al*. 2008, Front Ecol Environ 6, 493-498). These opposing views can only be reconciled via empirical data.

Recent work: Characterisation of emissions in smoke

Characterisation of emissions from two fuel types (green and dead leaves) at two moisture conditions (air dry and oven dry) with four combustion conditions (60-80, <300, 450 and 600 °C) from a small range of dominant eucalypts (e.g. *Eucalyptus obliqua*)

Next important steps

Quantify GHG emissions from other major overstorey and understorey fuel, litter and soil types under defined combustion conditions (temperature, oxygenation) to develop an emissions model

Refine model of emissions from combustion of vegetation and fuels under a range of conditions

Research aims

The research proposed **firstly** aims first to further develop our knowledge of greenhouse gas emissions of fuel reduction fires and their impacts on the carbon balance of forested ecosystems.

Secondly, we will investigate the mechanisms and processes in which GHG emissions can affect the environment in native forests and surrounding agricultural land.

Finally, we aim to use this knowledge to provide guidelines and advice as to how best to manage these fires to minimise their ecological and economic impacts.

Preliminary work: Ecological effects of smoke

Recovery of basic physiological processes (photosynthesis, transpiration, stomatal conductance) of grapevines after exposure to smoke

Next important steps

Measurement of the effect of smoke from other relevant fuel types (e.g. pasture grasses) under laboratory and field conditions

Additional physiological measures (e.g. amino acid production, chlorophyll content)

Use of native species and other horticultural or agricultural crops; different phenological stages of grapevine development (leaf burst, fruiting) and plant age (young plants, established vines); indications of longer-term impact (e.g. growth, fruit production)

Potential economic impact of smoke and other GHGs

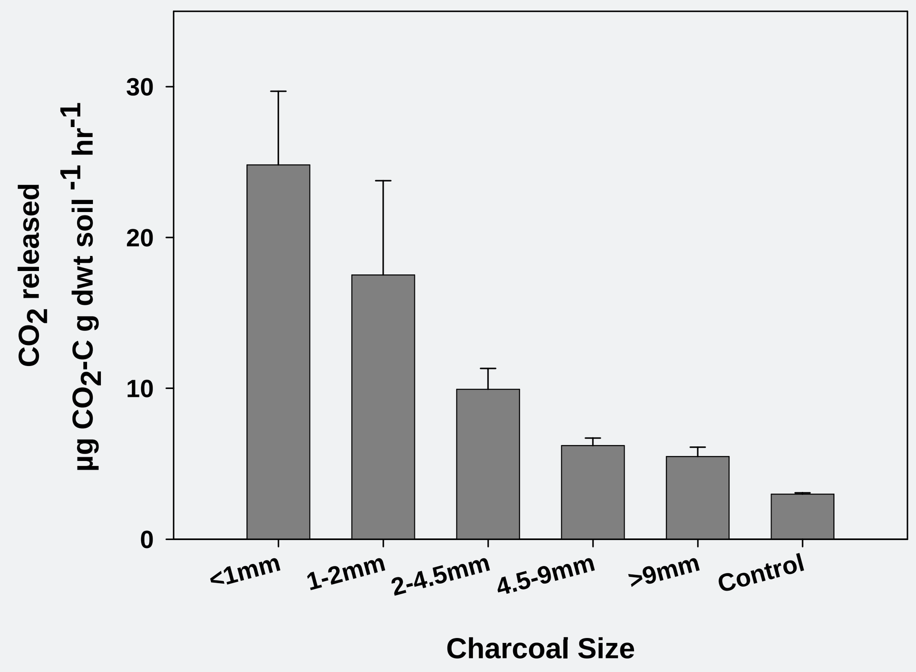
During the summer of 2006-07, fires in Victoria caused an estimated loss of revenue of $AUS75-90 million due to smoke taint in wine (Krstic, 2007, DPI).

The potential economic impact of smoke from wildfires is even greater internationally. For example, in the United States as the wine industry is estimated to be worth $US90 billion (MKF Research 2006).

The international need for research related to the effect of fire on agriculture is likely to escalate and Australian researchers are well placed to provide highly relevant scientifically-based information. The 'carbon' costs of fuel reduction fires are yet to be determined and will likely have direct economic value in future.

Preliminary work: Emissions from soil

CO_2 emissions from of soil with addition of carbon (ash and charcoal)



Next important steps

Measurement of a range of GHG emissions during laboratory and field incubations using a range of forest soil and vegetation types

Molecular typing of soil microbial populations

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